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## Lessons Learned – How to Make Them Stick

Jack Chosnek\*  
KnowledgeOne  
P.O. Box 451629  
Houston, TX 77245

\*Presenter E-mail: [jc@knowledge1.net](mailto:jc@knowledge1.net)

### Abstract

After an incident investigation we gather the facts, assign causes and compile a set of lessons that should, if learned well, prevent a similar incident from occurring. If the company has a good process safety management system, a good effort will be made to share the lessons learned with its employees. Unfortunately, too often we see the same type of incident happening, sometimes in the same company that had the original incident, although not necessarily in the same facility, or in a company using the same process technology as the company that had the incident.

What happened? We don't learn by listening to a talk or reading a bulletin, at least not for the long term. Our memory fades with time. Even if not, we still need to relate the incident findings to the planning and execution of our work. Thus, the way to remember those lessons is by incorporating them in our technology and daily operations. When making a change to the equipment, and during the safety study of the change, we need to consider what features we need to add or change in order to address the incident findings. In addition, operating, maintenance, and emergency procedures need to incorporate the incident findings. This can be done during the yearly review of procedures, or if the incident is closely related to the company's operations, as soon as the findings are analyzed.

Of course, a knowledge repository for the company is also necessary as we need to understand as time goes by, the basis for the changes in the technology and procedures. This is important in order not to lose the knowledge gained from the incident and unwittingly reverse the implemented protections.

Other methods, such as reviewing and discussing the finding in safety meetings on each anniversary of the incident, will also be discussed in this talk.

## **Introduction**

Incidents that happened before happen again, showing that we either are not paying attention to incidents or are not learning the lessons from those incidents. On October 1989, Phillips 66 experienced a major explosion during maintenance operations at its Pasadena, Texas, facility which killed 23 people and left more than a 100 injured. This explosion precipitated the enactment of OSHA's PSM Standard, 29 CFR 1010.119 [1]. Among the causes of the incident, OSHA cited faulty maintenance procedures. Ten years later, in 1999, an explosion rocked the same Pasadena facility resulting in two fatalities. Although in this case it wasn't a vapor cloud explosion but a release of molten material, it was again during maintenance operations. And a year later (2000) another explosion occurred in the same facility during maintenance operations, resulting in one fatality and 71 injured. Although the immediate causes for all these explosions were different, the common thread was maintenance operations. In another case, at Hoeganaes Corporation [2], there wasn't even a significant time span before incidents were repeated. In 2011 the company experienced three incidents in the same year: in January (two fatalities), in March (one serious injury) and in May (two fatalities). All three were related to a dust fire or explosion.

## **Why Are Lessons Not Learned?**

Lessons are not learned, not because of not trying. The Global Congress on Process Safety (AIChE) which meets once a year and has an attendance of hundreds of engineers and process safety professionals, has a joint session of all its tracks dedicated to lessons learned. The Center for Chemical Process Safety (CCPS) has published books [3] and maintains a database of incidents for participating companies [4]. Articles continue to be published on lessons learned in process safety [5] and a monthly bulletin provides an account of an incident or near miss from which we can learn [6]. The US Chemical Safety Board publishes online reports of its investigations and offers videos that demonstrate how the incident happened [7].

Companies typically circulate to employees the results of their own incident investigations and the reports are usually available internally. Sharing with other companies is limited due mainly to liability issues. But the lessons from those incidents may get lost, maybe because they don't have immediate impact or because the causes of the incident are not well defined, or because they get forgotten when they should be applied, during process design or a process hazards analysis (PHA). And, although many companies collect information on near misses, they are used as lagging-indicator metrics [8] for gleaning what are the factors that are liable to result in an incident, and mostly not thoroughly analyzed to learn the lessons they could have provided.

In essence, in spite of the wealth of incident information, the task of distilling a lesson from an incident, communicating it, and having people remember it when it's needed, is a very difficult task. Typically, in the long term we retain about 10% of the information we receive during training. And training is much more than sharing information where retention may be less than 1%.

## **How to Make Lessons Learned Stick**

In order to really learn a lesson, the lesson needs to be translated into everyday use. It needs to be woven into the fabric of the company. There are various ways of accomplishing this which will be discussed now.

1. **The Knowledge Repository.** Trevor Kletz, the world renown process safety expert, said that “Organizations don’t have memory – only people do” and that is why incidents recur [9]. But, with today’s tools it is possible to impart a memory to an organization [10], and part of that memory would be the lessons learned. One of these tools is a knowledge repository. The repository would be organized such that all aspects of the learnings from an incident would be available and be easily searchable [11]. Thus, our loss of memory of learnings from training or information sharing would be compensated by this repository. We would only need to have a vague idea about the incident and find all its details. This knowledge, though, needs to be incorporated into all the functions of a process plant.
2. **Expanding the Process Technology to Include Incidents.** The technology of the process being used would include any related incidents and the lessons learned from them. This searchable knowledge would go into the repository. For example, if the process used a hydrotreater, all relevant information on hydrotreaters would be added to the repository including any incidents, complete with the investigation reports. As part of the duties of the engineer supporting the process, he/she would follow incidents on hydrotreaters that occur in the world, within the company and externally. In addition, vendors would be asked to provide related incident data as part of the technical package. Some corporations have these technology experts that serve as a resource for the company, but it is not necessary to have a dedicated person to the technology since the information is readily available in the knowledge repository.
3. **Integrating Incident Learnings into a PHA.** Although we are required to review the incidents that have occurred between two consecutive PHAs, this review is for awareness that things can occur. It takes some expertise to connect these incidents to potential causes and consequences discussed during the PHA. An experienced facilitator that is familiar with incidents that have occurred in the industry should be chosen. And, since we are required to have “at least one employee who has experience and knowledge specific to the process being evaluated” [12], the process expert mentioned above should be part of the PHA team. If the expert doesn’t have the time to participate throughout the length of the PHA, he/she should give a presentation to the team on the incidents related to the process being studied.
4. **Using a Hazards Register.** A Hazards Register is a database that contains all the pertinent information related to the risks assessed during all of the safety studies performed by the company, whether a Process Hazards Analysis, or a Management of Change review, or an incident investigation [13]. The resolution of each hazard would be available in the Register, and not only the latest resolution but also its evolution (history) starting from the original study. The lessons of all these studies are captured in the Hazards Register since it maintains the reasons and assumptions used in them. This solves the problem of the disconnect between recommendations from a safety study and their resolutions. At any time, we can learn why

we use a particular design or operate in a certain way. In order to be effective, the Hazards Register should be easily accessible by all and be fully and effortlessly searchable.

5. **Integrating Incident Learnings into SOPs.** We are required to include the consequences of deviation when the performing of an SOP. This is a good place to add to the consequence a mention of an incident that occurred when not following an instruction. For example, on bypassing an interlock, a note saying “A bypassed interlock using emergency air resulted in an explosion that destroyed the facility and killed five people” [14]. A video or report of the incident should be available in the control room, or at least used in refresher training.
6. **Remembering the Anniversary of an Incident.** If there was a significant incident in the company, the lessons learned from it should be remembered every year. The anniversary of the incident is the right time to do it. The company should send a bulletin to all employees on that day with a summary of the event [15].
7. **Reinforcing Lessons in Safety Meetings.** For safety meetings or “tool box” meetings one of the topics should be the review of an incident, not necessarily something that happened in the company, but of actions that led to an incident. The videos offered by the US Chemical Safety Board are an excellent resource for this type of meeting.

## Conclusions

By using the methods described in this paper, lessons are learned through visualization, constant application and reinforcement. Since the lessons become part of the knowledge of the company, and the methods integrate the lessons into everyday activities of the company, these lessons will stick.

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